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Report for July-December 1957 Issued January 1958

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North Dakota

NITROGEN FERTILIZER INCREASES EFFICIENCY OF WATER

Carl W. Carlson, Joe Alessi, Rome Mickelson, and Russell Lorenz, Mandan. -- Studies have been conducted near Upham, North Dakota, on the moisture and fertility requirements of bromegrass and corn grown under irrigation on Gardena loam. The bromegrass study was cooperative with the Forage and Range Research Branch, Crops Research Division, ARS, and the Agricultural Engineering Department of North Dakota Agricultural College. Periodic soil moisture samples were taken on key fertilizer treatments, at 1-foot depth increments to 4 feet, before and after irrigation and following rainfall of appreciable amounts.

Data presented in Table 1 show that evapotranspiration for bromegrass was the same regardless of nitrogen level or stage of development when harvested. At the same time nitrogen additions more than doubled dry matter production when harvested as pasture (clipped when 6-8 inches high), and more than tripled dry matter production when harvested as hay. The reduction in water requirement per unit dry matter produced, due to the application of nitrogen fertilizer, was large in both harvest systems. Water requirement values for all treatments were higher than those obtained in 1955 due to winter injury occurring in the winter of 1955-56.

TABLE 1.--Total evapotranspiration, dry matter produced, and pounds of water required per pound of dry matter for bromegrass grown as pasture and hay at various nitrogen levels, Upham, North Dakota, 1956*

Fertilizer treatment per acre		Pasture (clipped)			Hay (unclipped)		
N	P_2O_5	Evapo-transpiration	Dry matter yield per acre	Water per pound of dry matter	Evapo-transpiration	Dry matter yield per acre	Water per pound of dry matter
Pounds	*Pounds*	*Inches*	*Pounds*	*Pounds*	*Inches*	*Pounds*	*Pounds*
0	200	25.81	1,000	5,850	25.04	1,220	4,650
40	200	25.35	1,620	3,540	25.91	1,900	3,090
80	200	26.35	1,880	3,180	25.35	2,680	2,140
160	200	25.59	2,640	1,590	26.24	4,040	1,470

*Irrigated when 20-30 percent available moisture remained in root zone (4 atmos. tension or less).

Similar data were obtained for corn grown at Upham, North Dakota. In this experiment 2 plant populations and 3 nitrogen treatments were used. Soil samples were taken on plots receiving 0 and 120 pounds of nitrogen in both plant populations. Table 2 shows that evapotranspiration was about the same regardless of plant population or fertilizer level. At the same time dry matter production was increased more than 50 percent by nitrogen fertilization. The water requirement per unit dry matter produced was reduced considerably when nitrogen was applied to either plant population.

TABLE 2.--Total evapotranspiration, dry matter produced and pounds of water required per pound of dry matter for corn grown in two plant populations at two nitrogen levels. Upham, North Dakota, 1956*

Fertilizer treatment per acre		Plants per acre	Evapotrans-piration	Dry matter yield per acre	Water per pound of dry matter
N	P_2O_5				
Pounds	*Pounds*		*Inches*	*Pounds*	*Pounds*
0	200	14,000	16.40	5,870	519
120	200	14,000	17.20	9,330	353
0	200	23,000	18.10	6,870	514
120	200	23,000	16.44	10,630	295

*Irrigated when 50 percent moisture remained in the root zone.

These data show that increased yields can be obtained per unit of water used when a yield response to added fertilizer materials is observed. It appears that yields can be increased without using additional water, if consideration is given to fertilization and to other production factors.

Idaho

NEW STUDY INAUGURATED ON "SLICK SPOTS"

Warren W. Rasmussen, Boise. --An estimated 250,000 acres of irrigated and potentially irrigated land in the Lower Snake River Valley in southwestern Idaho and southeastern Oregon are seriously affected with "slick spots"--small, irregular areas of saline-alkali soil. The existence of the spots in the irrigated lands constitutes a serious economic problem; the areas are unproductive; they hamper farming operations and greatly decrease land values.

The "slick spot" soils are characterized as follows:

1. A horizon--thin
2. Upper B horizon--fine textured non-calcareous with high exchangeable sodium and moderate salt content.
3. Lower B and upper C horizons--coarser textured, containing high exchangeable sodium, large quantities of soluble salts, and some gypsum.
4. Lower C horizon--moderately compacted with high lime content, overlying moderately to strongly cemented lime hardpan or caliche 18-20 inches thick beginning at 38-42 inches depth. This is underlain by unconsolidated to poorly consolidated granitic sand and gravel.

The soils have very low infiltration rates and fail to absorb sufficient moisture during irrigation for normal plant growth. Plant root penetration is restricted both by limited soil moisture and by the cemented subsoil layers.

At least 3 conditions appear to be operating in limiting moisture penetration and plant growth under field conditions, namely: (1) the fine textured B horizon, (2) the large quantities of exchangeable sodium and soluble salts, and (3) the compacted and cemented subsoil layers. A successful reclamation procedure would appear to hinge on some practical means of correcting or modifying the limiting factors under field conditions. Considerable research has been conducted on the "slick spot" problem, but no adequate, feasible reclamation procedure has been established. (For a report of some earlier work on this problem see Progress Report #9, pp 6-8.)

A field plot study was established in 1957 to determine the effect of the addition of gypsum, physical mixing and subsoiling treatments on the physical and chemical properties and productivity of the "slick spot" soils. Application of the several treatments was completed about August 20 and the crop (a mixture of alfalfa, orchard grass, and tall wheat grass) seeded. The initial data indicate that all treatments greatly increased the infiltration rate of the soil over the check plots. An adequate crop stand was obtained on all plots with the exception of the deep mixed plots. The high salt content of the lower subsoil layers when brought to the surface by mixing was apparently too high to permit adequate seed germination.

No excess leaching treatments were planned in the experiment, since the steeply sloping lands of the study area are generally not suited to practical leaching procedures. It is expected that sufficient leaching may be obtained through applying some excess water during normal irrigations.

Plant growth following germination has been variable on all the "slick spot" plots, with quite limited growth occurring on the deep and shallow mixed plots. The excess soluble salts brought to the surface by mixing has apparently limited plant growth. Future irrigation applications in amounts calculated to give some leaching, together with winter precipitation, may reduce the salt content sufficiently to permit good plant growth.

No significant conclusions are to be made from the limited initial data.

Texas

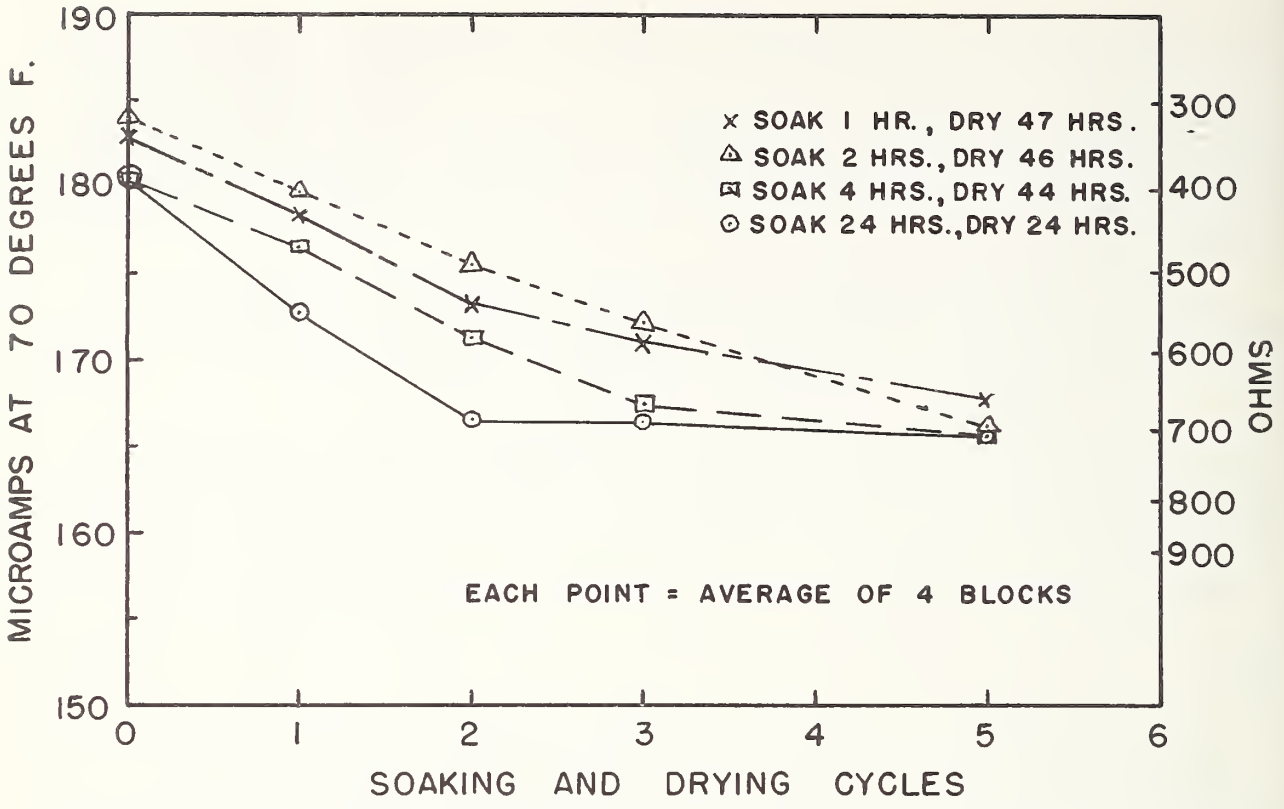
METHOD RECOMMENDED FOR CURING MOISTURE BLOCKS

M. E. Jensen, Bushland. --Gypsum soil moisture blocks made at various field locations should be cured before use to remove the initial drift in calibration that occurs after the first wetting and drying cycle. Several procedures for curing gypsum blocks were tried and the best results were obtained when soaking the blocks for 24 hours, drying for 24 hours, and then repeating this cycle. The curing process should eliminate much of the initial drift that would occur in the field.

The accompanying tabulation shows the change that takes place between groups of blocks during the curing process and the error (microamperes) for the blocks which were selected at random. Five treatments were used, but only four are plotted in the accompanying graph.

Component	d.f.	Cycle					
		0	1	2	3	4	5
Between treatments (MS).....	4	11.0	27.5	51.0	24.5	--	2.8
Error (MS).....	15	10.3	12.0	11.9	7.5	--	5.5
Standard deviation (microamperes).....		3.2	3.4	3.4	2.7	--	2.3

The difference between treatments at the first and after the fifth wetting cycle is approximately the same as the error. The difference between treatments increased during the first two cycles of the curing process then decreased from the third to the fifth cycle until very little difference existed between the methods of curing. However, only two 24-hour wetting and drying cycles are required to remove most of the drift. The curing process also decreases the variability between blocks.



The effect of curing gypsum blocks made at Bushland, Texas, on removal of initial drift in calibration. Readings were made in tap water after soaking one-half hour.

New Jersey

IRRIGATION MAY INCREASE RUNOFF IN HUMID AREAS

G. D. Brill and G. R. Blake, New Brunswick. --Irrigation of vegetable crops may be expected to increase both rate and amount of runoff from rainfall according to a study at New Brunswick, New Jersey. Higher rates of runoff may be expected as a result of irrigation in years of excessive or near normal rainfall. With the more intensive tillage and traffic associated with truck crops, runoff might be even higher as a result of irrigation.

Runoff from irrigated and nonirrigated plots with 2 soil management systems was measured over a 7-year period (1949-1955). Sweet corn followed by a rye cover crop was grown continuously and in rotation with a grass legume sod every third year. One inch of water was applied to half of the plots when the soil moisture tension at 9 inches reached 1 atmosphere. Plots were small, 1/200 acre, and were plowed and cultivated with a garden tractor. Severe droughts occurred during 1954 and 1955.

Runoff from sweet corn during the irrigated season (after first irrigation through harvest) is shown in the accompanying table.

Although none of the irrigation water ran off, water losses were consistently higher from the irrigated plots except in 1955. Lower runoff from the irrigated plots in that year was due in part to the better ground cover provided by the irrigated corn. Runoff from sweet corn following sod was consistently less than from continuous corn. However, the effect of the sod was greatly decreased in the second year of corn.

Runoff from storms during the irrigated season, New Brunswick, N. J., 1949-1955

Year	Irrigations	Runoff		
		Continuous sweet corn	1st year sweet corn	2nd year sweet corn
	Number	*Inches*	*Inches*	*Inches*
1949.....	9	----------	None	----------
	None	----------	None	----------
1950.....	4	2.18	0.68	----------
	None	1.02	0.58	----------
1951.....	3	0.98	0.54	0.64
	None	0.36	0.13	0.28
1952.....	2	3.12	2.55	3.02
	None	2.58	2.13	2.05
1953.....	3	0.17	0.09	0.16
	None	0.02	0	0.01
1954.....	3	0.45	0.16	0.07
	None	0.18	0.03	0.04
1955.....	4	0.88	0.34	1.13
	None	1.25	1.05	1.47

Alabama

FLEXIBLE TUBING REDUCES LABOR IN SPRINKLER IRRIGATION

Herman Bouwer, J. O. Helms, and W. C. Little, Auburn.--Flexible tubing reduced the labor requirements of sprinkler irrigation in corn, eliminated the need for carrying metal lateral pipe, and reduced the walking distance involved. The data are summarized in the accompanying table.

Sprinklers were mounted on tripods and connected to the lateral with 1-inch plastic-hose branches of a length equal to the distance between consecutive sprinkler settings. The sprinkler spacing was 60 x 80 ft. and the lateral consisted of 2-inch polyethylene pipe. Three sprinkler settings were possible from 1 position of the lateral. Two moves consisted of moving sprinklers only while letting plastic hose drag. For the third move, the lateral was rolled on a 6-ft. diameter trailer-mounted reel, moved a distance of 240 ft., and rolled out. The sprinklers were then moved 80 ft. and reconnected to the lateral with the plastic hose. The plastic branches were also used in combination with an aluminum lateral, which was moved by a tractor and trailer.

Since 2 out of every 3 moves had very low labor requirements, branched laterals may enable a higher degree of equipment utilization through an increased number of moves per day. The plastic branches also permit use of smaller pipe sizes for the lateral, since excessive pressure variations in the lateral can be compensated by proper selection of the diameters of the plastic branches. Branched laterals also require 1/3 as many main-line control valves as conventional systems. Trafficability for mechanized moving of the lateral may also be improved, since there is 1 more sprinkler setting between the time that the soil at the lateral receives irrigation and the time that the lateral needs to be moved.

Labor requirements for 3 sprinkler irrigation systems operating in corn, Auburn, Ala.

Description of sprinkler irrigation system	Labor requirements in corn, per irrigation per acre				Calculated walking distance, average per acre per irrigation per 3-move cycle
	First move	Second move	Third move	Average per 3-move cycle	
	Man-hours	*Man-hours*	*Man-hours*	*Man-hours*	*Man-feet*
Conventional system with hand-moved aluminum lateral.....	1.0	1.0	1.0	1.0	6,200
Aluminum lateral with plastic branches	0.2	0.2	1.4	0.6	3,790
Flexible lateral with plastic branches	0.2	0.2	0.8	0.4	2,940

DRAINAGE

Florida

LAND LEVELING PRECISION IMPROVED BY AUTOMATIC EQUIPMENT

John C. Stephens, Ft. Lauderdale, and Dalton S. Harrison, Belle Glade. --The results of a recent test at Belle Glade have shown that the precision leveling of organic soils, which is necessary to eliminate surface ponding and to maintain uniform depths to water table where crops are subirrigated, may be accomplished with greater precision by the use of automatically adjusted hydraulic scraping machinery than with manually adjusted floating type equipment. This finding is based on maximum deviations in elevation measured over each of four 3-acre plots leveled by a machine of each type. Maximum deviations for each of the plots, arranged in descending order, were as follows:

Machine type	Maximum deviations			
	Inches	*Inches*	*Inches*	*Inches*
Automatic.....	4.6	4.0	3.2	3.1
Manual.....	8.0	7.8	4.8	4.4

Virginia

LANDFORMING COSTS NOT EXCESSIVE

Phelps Walker and J. H. Lillard, Blacksburg. --The drainage efficiency of land formed to control only row grades is being compared to land formed to control both row grades and side slopes in Virginia. In this field experiment, time requirements and engineering procedures for land forming have already been evaluated. A 2-plow farm tractor with matching tillage tools, a 75-horsepower track-type tractor, a 7-cubic yard scraper, and a 30-foot landplane were used for the several forming operations.

Natural land slopes ranged from level to 0.5 percent. Surface irregularities required an average of 105 feet per acre of hand-maintained field drains to empty the low pockets into the permanent ditches in previous farming operations.

The formed area consisted of 4 plots. Two of these were 200 feet wide, the normal spacing of lateral ditches in that area. The other 2 plots were approximately 425 feet wide. Plot lengths ranged from 925 to 1,225 feet. Both of the larger plots and 1 of the smaller ones were graded in both cardinal directions and diagonally, resulting in a surface plain sloping with the natural topography of the land. These are referred to as completely formed. The other small plot was graded with all earth moved parallel to the direction of future crop rows (parallel to permanent ditches). This method is referred to as longitudinal forming. The ridged crop rows become an integral part of this forming method and are necessary to conduct the runoff water to field drains.

The machine-hour and man-hour requirements for each landforming operation are summarized in the accompanying table. The per-acre time requirements for complete forming and for longitudinal forming were almost equal for each operation with the exception of the much lower machine-hour requirement for primary grading of the longitudinally formed plot. Limiting landforming operations to grading in 1 direction reduced the heavy machinery requirement by approximately 67 percent.

Time requirements for land forming operations, Baum Farm, St. Brides, Va.[1]

Operation	Units	Time per acre	
		Forming methods	
		Complete	Longitudinal
		Hours	*Hours*
Initial plot preparation (disking, plowing, disking to incorporate trash into soil)	Machine	1.6	1.5
Final plot preparation (removing stumps and debris from plots and filling interior ditches)	Machine Man	0.5 0.7	0.5 0.7
Primary forming (grading with heavy equipment)	Machine	2.1	0.7
Finish Forming (smoothing with landplane)	Machine	2.0	1.9

[1] Average cut: 0.27 ft.
Average fill: 0.22 ft.
Average haul distance: 430 ft.
Average earth moved per acre--Complete forming: 209 cu. yd.
Longitudinal forming: 67 cu. yd.

Landforming costs per acre computed at $4.50 per hour for farm equipment and landplane, $18.00 per hour for heavy equipment, and $1.00 per hour for labor resulted in a total cost of $62.00 per acre for the complete forming method and $35.00 per acre for the longitudinal forming method. Most of the difference is due to the reduced use of heavy equipment for the primary forming operation in the latter method.

The experiment is being continued to evaluate the drainage efficiency of both forming methods.

Indiana

RESIDUAL EFFECTS OF WINTER COVER CROPS MOST IMPORTANT

W. H. Wischmeier, Lafayette.--According to an analysis of soil loss data assembled from Pennsylvania, South Carolina, Mississippi, Georgia, Texas, and Oklahoma, the soil conserving value of winter cover crops is determined both by beneficial residual effects carried over into the next crop season and by the protection it provides during the winter months.

The residual benefits appear to be derived either from the fibrous root development or from a change in soil structure prior to spring plowing. It does not appear to be associated with the winter top growth.

The soil losses were measured from row crops following (1) winter cover crops turned under and (2) corresponding losses from row crops without a winter cover. Two periods were compared, the loss during the winter and the loss from the row crop which follows. The soil conserving value of the cover crops by type of cover for the two periods is shown in the accompanying figure.

Under the rainfall patterns in some areas, winter erosion hazards are small enough that retention of crop residues on the surface affords adequate winter-time protection. Where these conditions exist, the effects of winter cover on soil erosion must be evaluated solely on their residual benefits through the succeeding crop season.

Well established covers of grass, vetch or crotolaria reduced soil loss during the succeeding row-crop period more than during the winter period. Reductions during the winter months were, however, also significant. Wheat winter cover for cotton in Oklahoma and oats cover for corn in Texas did not show any such residual effects on erosion in the following year.

The year to year data emphasize the need for careful selection of the type of winter cover to be seeded and the importance of time and method of seeding, so that the full benefit of residual effects in the succeeding crop year may be realized.

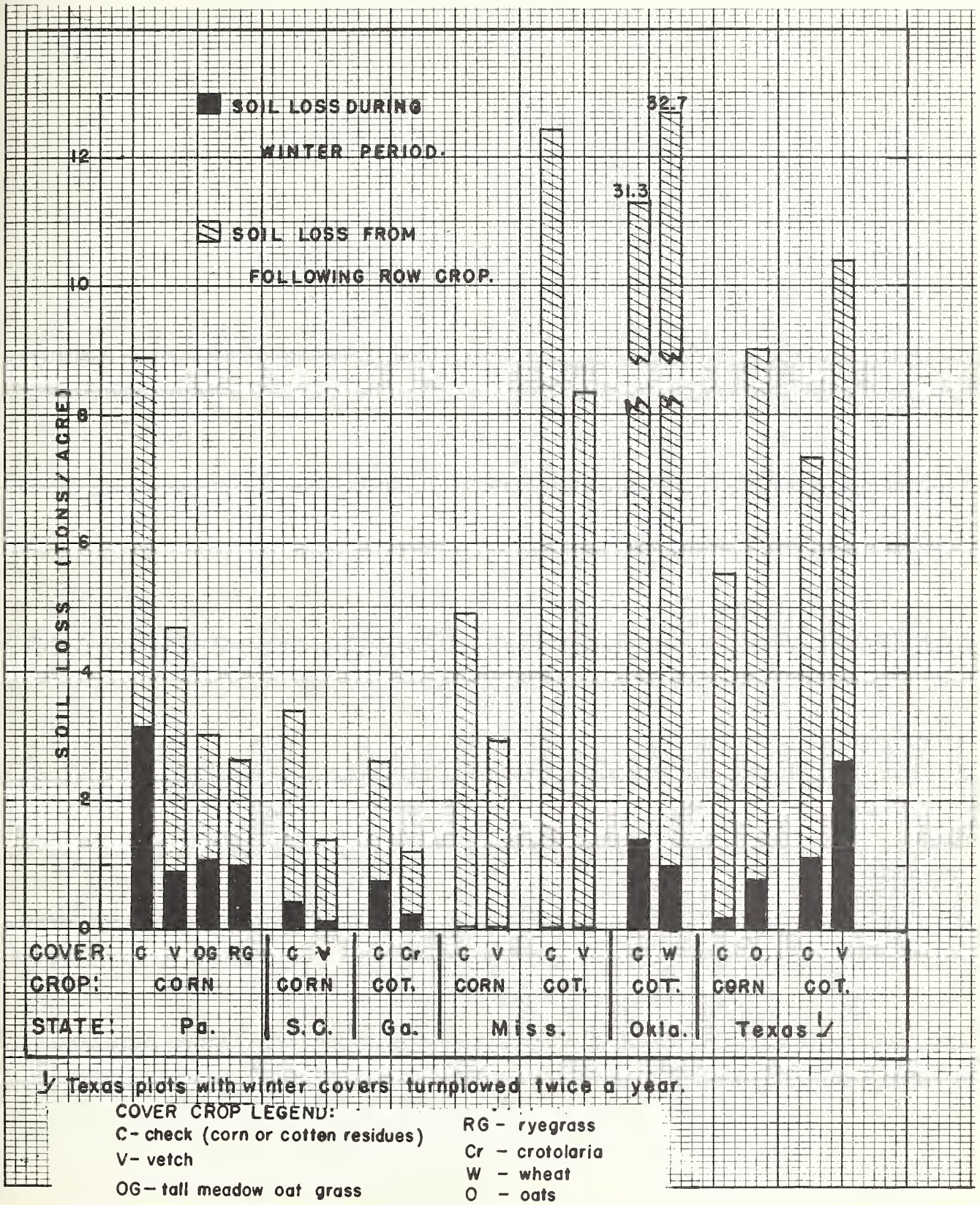
Missouri

CONTOUR FARMING FAILS ON LONG SLOPES DURING HEAVY STORM

F. D. Whitaker, J. F. Thornton, and V. C. Jamison, Columbia.--Data from the McCredie plots showing the loss of 10.5 tons per acre of soil in 1.88 inches of runoff clearly illustrates that contour farming is hazardous on long slopes. Unless the contour rows have proper grades to carry accumulated runoff water during heavy rains to grassed waterways or other means of disposal, soil losses may be extremely high.

The plots at McCredie, Missouri, on which these data were obtained are one acre in size and have a slope length of 420 feet. The average land slope is 3 percent and the lower one-half of the plots have a slope of 4.1 percent.

A heavy rain with high intensities occurred on June 29, and 30, 1957, following a period of above-normal rainfall. Soil moisture levels were near field capacity on cultivated land. The corn plants were small, since this rain occurred only 3 weeks after planting and a few days after the first cultivation. Surface sealing of the soil and rainfall intensities much higher than the infiltration rate of the soil caused high rates of runoff carrying large quantities of soil. The maximum runoff rate was 3.75 inches per hour. Rain with intensities of 2.36 inches per hour for 30 minutes, 3.52 inches per hour for 15 minutes, and 6.24 inches per hour for 5 minutes filled all furrows made by farm implements. When the furrows started breaking-over, a volume of water was created large



Immediate and residual soil conserving effects of winter cover crops turned under as green manure, Lafayette, Ind.

enough to sweep all loose soil in wide areas down the slope. In addition to the soil carried off the plots, large quantities were deposited at the lower end of the slope as shown in the accompanying picture of the lower section of 1 of the plots.

Lower end of contour cultivated plot 420 feet long following intense storm 3 weeks after corn planting, McCredie, Mo.

These data indicate that reducing slope lengths by terracing or stripcropping are necessary to cultivate rolling land safely. Even with the poor practice of tilling up and down the slope, soil losses from comparable plots with a slope length of 90 feet were 2.5 tons per acre. Although losses of 2.5 tons per acre are very high, they are considerably lower than 10.5 tons per acre lost on contoured areas with longer slope lengths.

Missouri

RUNOFF FROM MAJOR STORM USES SMALL PORTION OF TERRACE CHANNEL

F. D. Whitaker and J. F. Thornton, Columbia.--Less than 10 square feet of channel cross section area was used to carry runoff from a heavy rain of 4.23 inches from terraces 1,050 feet in length at the Midwest Claypan Experimental Farm at McCredie, Missouri. Staff gage measurements of the area of flow when the maximum runoff rate reached 3.04 inches per hour showed that only 9.5 square feet or 42 percent of the average cross section area was used near the outlet end of the terraces. Only 1.4 square feet or 6 percent was used 250 feet from the upper end. Runoff rates of this magnitude are expected only once in 10 to 15 years.

Rainfall intensities for this storm were high, 2.36 inches per hour for a 30-minute period, 3.52 inches per hour for a 15-minute period, and 6.24 inches per hour for a 5-minute period.

Flow area and percent of the total cross section area used for this runoff and that of a less severe storm occurring in 1956 are shown in the accompanying table. These data are from 4 terraces with an area of 2.25 acres each. Terrace heights were increased from 0.97 to 1.22 feet and the channel cross section area was increased from 16 to 22.5 square feet by one plowing when preparing a seedbed for the 1957 crop. Depth of flow for the larger storm is shown on the lower line of the table. These were the only storms causing runoff at a rate greater than 0.5 inch per hour since the study was started in 1950.

TABLE 1.--Flow area and percent of total channel area used during the 2 storms causing over 0.5 inch maximum rate of runoff from graded terraces at McCredie, Missouri, during the period 1950-57

Rain		Maximum runoff rate per hour	Amount of channel used							
			Distance in feet from upper end of terrace							
Date	Amount		1000		750		500		250	
			Area	%	Area	%	Area	%	Area	%
	Inches	*Inches*	*Sq. Ft.*		*Sq. Ft.*		*Sq. Ft.*		*Sq. Ft.*	
7/3-4/56	1.86	.86	5.5	34	3.0	19	2.4	15	1.3	8
6/29-30/57	4.23	3.04	9.5	42	3.8	18	3.4	15	1.4	6
6/29-30/57	Maximum depth of flow (Feet)		.70		.44		.43		.25	

The soil had little vegetative cover at the time of the June 29-30, 1957, storms which occurred only 18 days after soybeans were planted. The soybeans planted in 40-inch rows were not quite large enough for cultivation. Soil moisture was near field capacity. Surface sealing of the soil and rainfall intensities far greater than the infiltration rate of the soil caused high rates and amounts of runoff. Runoff was 2.29 inches or 54 percent of the total rainfall.

These terraces are on Mexico silt loam soil with a landslope of about 3 percent. Channels are 4 to 5 feet wide with about 10:1 front ridge slope and 14:1 slope above the channel.

Allowing 5 to 6 inches freeboard above the expected flow, these data indicate a channel area of 20 square feet is adequate for the outlet end of terraces of similar length, grade, spacing, and management practices for a 15-year runoff even when heavy rains occur on this soil with little vegetative cover. Dimensions for shorter terraces could be somewhat smaller.

Maine

COARSE SOIL PARTICLES INCREASE INFILTRATION, REDUCE EROSION

W. J. Grant and R. A. Struchtemeyer, Orono.--The amount and size of soil particles over 2 mm. in diameter increase the infiltration rate and reduce the erodibility of Caribou and Thorndike soils in Maine.

Infiltration rates of these soils as measured with a laboratory infiltrometer were decreased when coarse material greater than 1/4 inch was removed. The amount of soil loss by erosion from small pans was even more striking as indicated in the following table. When material over 2 mm. was removed, erosion losses increased as much as 8 times for the Caribou soil and nearly 27 times for the Thorndike soil.

Average infiltration rates and soil erosion losses during the third hour of simulated rainfall[1], Orono, Maine

Soil treatment	Mean infiltration rate		Erosion losses	
	Caribou	Thorndike	Caribou	Thorndike
	Inches per hour		*Grams*[2]	
Natural soil	2.01	2.24	1.10	0.18
Over 1/2 inch removed	1.40	1.49	3.23	0.70
Over 1/4 inch removed	0.97	0.76	5.36	2.60
Over 2 mm. removed	0.93	0.58	8.67	4.83

[1] Simulated rainfall applied at a rate of 2.5 inches per hour. The soil had previously received 2 hours of simulated rain on the 2 preceding days.

[2] Grams of soil removed from soil sample (394 sq. cm.) during 1 hour of simulated rainfall.

New York

FREQUENCIES OF INTENSE RAINFALL REPORTED FOR MARCELLUS

G. R. Free, Ithaca.--A study of 21 years of rainfall records at Marcellus, New York, shows that there have been at least 2 inches of rainfall of over 1 inch per hour intensity each year. In 1941 and 1947 there were as much as 9 inches of intense rains which accounted for severe erosion losses.

A summary of the data are shown in the table. There appears to be about a 50-50 chance of getting 1 inch of intense rain (over 1 inch per hour) in June or July. There were only 2 years out of the 21 where less than 0.25 inches of intense rain occurred in June or July.

Number of times in 21 years at Marcellus, New York when amount of intense (over 1 inch per hour intensity) rain per month or season exceeded amounts shown below

Amount	March	April	May	June	July	August	Sept.	Oct.	Seasonal basis Mar.-Oct.
Over 0.25 inches	1	5	9	19	19	16	14	5	21
" 0.50 "	0	1	4	16	16	13	10	1	21
" 0.75 "	0	0	4	12	11	7	7	0	21
" 1.00 "	0	0	2	9	10	6	4	0	21
" 1.50 "	0	0	1	1	5	3	2	0	21
" 2.00 "	0	0	0	0	4	1	1	0	21
" 3.00 "	0	0	0	0	2	0	0	0	17
" 4.00 "	0	0	0	0	1	0	0	0	7
" 5.00 "	0	0	0	0	1	0	0	0	5
" 6.00 "	0	0	0	0	1	0	0	0	3
" 9.00 "	0	0	0	0	0	0	0	0	2
" 10.00 "	0	0	0	0	0	0	0	0	0

Georgia

BERMUDA SEEDING PRODUCED QUICK ROADSIDE COVER

E. C. Richardson, Cartersville. Common Bermuda seeded on roadside cut slopes produced almost complete protection in 2 to 2-1/2 months at the new roadside erosion control research project at Cartersville, Georgia. Better stands were secured without a mulch, although poor survival of plants and poor growth occurred on the top third of the steeper slopes. The thinner stands on the mulched plots, which were uniformly distributed from top to bottom of the banks grew rapidly and by the middle of June produced as good cover as the thicker stand on the unmulched plots.

Hulled Bermuda seed was broadcast by hand at the rate of 20 pounds per acre. On mulched plots, seed was sown on top of the mulch without covering. On the unmulched plots, seed was raked into the soil with a garden hoe, which left little furrows in the soil surface approximately 8 to 12 inches apart. A uniform fertility treatment of 1 ton 4-12-12 fertilizer, 2 tons ground limestone, 5 tons of chicken manure per acre was applied broadcast on all plots.

The plots, 50 to 100 feet long and on slopes ranging from 4 to 1 as steep as 1-1/2 to 1, were laid out on highway banks perpendicular to the road surface. Plots were subdivided on 25 and 50 feet intervals with one-half of each plot mulched, the other half unmulched.

The value of a vegetative cover in controlling erosion is illustrated in this photograph from the roadside erosion control study at Cartersville, Ga.

New Hampshire

NEW GULLY CONTROL STUDY STARTED IN NORTHEAST

R. S. Palmer, Durham. --The formation of gullies within the river systems of New England has been an impediment to farming. Numerous methods of gully control have been tried with varying degrees of success. In cases where surface runoff has been the principal cause, standard drop inlet structures have sometimes been installed. A few farmers have installed a dry well above diversion constructed around the gully head as shown in figure 1. Vegetative plantings have also been employed, but vegetation cannot arrest further damage until mechanical stabilization of the planting area has been achieved.

Gully formation, as shown in figures 2 and 3, has been attributed to rodents and to increased surface runoff resulting from intensive land use. Observation indicates that a large percentage of gully development takes place in the spring from melting snow. Many of the gully formations appear to have been extended by subsurface seepage.

A study was established in June 1957 to gain an understanding of the development of these gullies, and to develop practical methods for their control. Profiles and cross section data will be used to measure seasonal changes following runoff after the spring thaw, in the summer, and again in the fall before snowfall.

Piezometric investigations of ground water profile and measurements of hydraulic conductivity of the soil are also contemplated, as well as measurement of rainfall, rates and amount of runoff, and seepage flow.

Figure 1. --A type of gully control being tried by several farmers in the Connecticut valley. It consists of a level diversion constructed around the head of the gully and a dry well to drain the impounded water. The well is 8 feet deep made of two sections of 4 foot diameter tile.

Figure 2. --Active gully in Windsor loamy sand at Piermont, N. H. Note the blocks of sod which have fallen into the gully from above. Poor vegetal cover contributed to the development of this gully in the spring of 1957.

Figure 3. --Active gully in Suffield silt loam on second terrace of the Connecticut Valley at Orford, N. H. Markers are placed in the gully as a guide in the measurement of the cross-section dimensions during different seasons. Note varved clay layers near level rod indicating location of a prehistoric lakebed. Drainage comes from an abandoned pasture.

SOIL FERTILITY

Puerto Rico

FERTILIZED, IRRIGATED GRASSES PRODUCE HIGH YIELDS

Jose Vicente-Chandler, Rio Piedras. --Two experiments conducted near Santa Isabel on the semiarid South Coast of Puerto Rico on intensively managed tropical grasses show high yields and economical beef production.

Heavily fertilized, irrigated merkergrass pastures produced 1,346 pounds of beef per acre during the first year of a grazing experiment. Guineagrass pastures produced 1,182 pounds and pangolagrass, 1,047 pounds of beef per acre yearly in this same experiment.

In a small plot experiment, irrigated and heavily fertilized merkergrass produced 63,702 pounds of dry matter (166 tons of green forage) per acre yearly with a protein content of 10.4 percent. Heavily fertilized guineagrass produced 46,205 pounds, sorghum 26,854 pounds and pangolagrass 24, 273 pounds of dry matter per acre yearly. It is estimated that the merkergrass, if completely utilized, should support 10 steers per acre

weighing an average of 600 pounds and gaining at the rate of one-and-a-quarter pounds daily. It is believed that the productivity of these pastures will be increased considerably during the coming year through the use of better management practices.

Maryland

REGIONAL LIME PROJECT STARTED THIS YEAR

Robert W. Pearson, Beltsville. --A regional lime project was begun this year to measure the response of forage legumes and grasses and other important crops to rates, sources, and placement of limestone. The project includes a series of some 50 uniform field experiments at 26 sites located on soils selected to represent the most important soil associations of the Southeast. The sites, which were chosen to provide the normal range in soil characteristics found within each association, fall in Arkansas, Mississippi, Alabama, Georgia, Kentucky, Tennessee, South Carolina, Florida, and Puerto Rico. These field experiments are supported by fundamental laboratory and greenhouse studies on the nature of the effects of liming on soil characteristics and plant growth.

This project was developed in cooperation with the States listed above. It was initiated because of the increasing seriousness of the soil acidity problem in the humid region and particularly in the poorly buffered, highly weathered soils of the Southeast. While the soil acidity problem has always existed in this area, the present critical situation is a result of a decline in the use of limestone in the last decade, coupled with an increasing use of more intensive management practices including much higher rates of acid-forming nitrogen fertilizers. Much of the experimental work done with lime in this area in the past has been restricted to lime vs. no lime treatments in connection with fertilizer trials. As a result there are wide gaps in our knowledge of the optimum levels of lime for different crops on the various soils of the area and procedures for predicting this response.

The present project aims to complement past research and fill in these gaps.

Idaho

RESULTS OF FERTILIZER TESTS ON DRYLAND WHEAT ARE PROMISING

F. H. Siddoway, St. Anthony. --Two fertilizer experiments established on the Rexburg Bench in cooperation with the Madison County agricultural agent showed wheat grain yields increased with the application of 20, 40, and 80 pounds of nitrogen per acre. Vegetative development of the crop was increased far out of proportion to the yield of grain. Yet, this visual evidence of response to fertilization was misleading since the grain from plots receiving 80 pounds of nitrogen was shriveled, test weight was lowered, and in one case the grade was reduced from No. 1 to No. 3.

One site had a southern exposure and a soil which appeared to be in poor condition due to past erosion. The second site was nearly level and more typical of the better soils of the area.

At the time fertilizer was applied, the soil moisture content was near field capacity to a depth of 4 feet. Precipitation was well above normal for 2 months following the fertilizer application. No effective precipitation was received

Vegetative response of wheat to nitrogen fertilizer, St. Anthony, Idaho, 1957

from the last week of June until harvest on August 5. Color and growth differences were observed throughout the growing season.

Fertilizer usage on the drylands of southeastern Idaho has been meager, but these trials and others conducted by other agencies show that a potential for response does exist. Before reliable recommendations can be made, however, an extensive fertilizer research program will have to be carried out over the entire area to correlate response with nitrogen rates, soil fertility level, soil moisture, and probably climate.

New Mexico

SORGHUM AFFECTED BY P_2O_5 APPLIED TO THE ALFALFA IN 1951

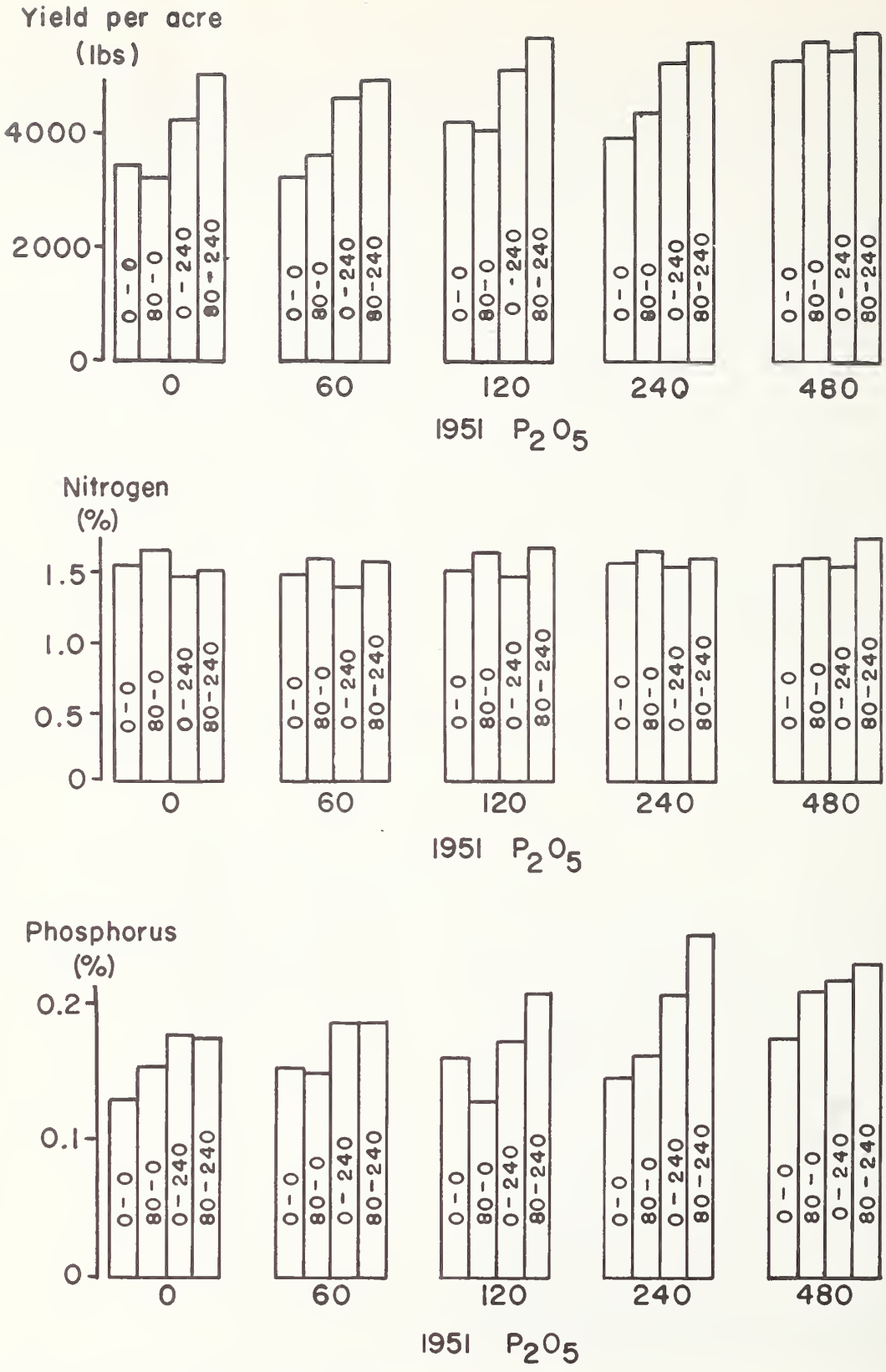
Ross W. Leamer, State College. --Phosphorus applied to alfalfa in 1951 affected yield and composition of grain sorghum grown in 1956. This was demonstrated on a rotation experiment started in 1951 at Tucumcari, New Mexico. Phosphorus was drilled into the seedbed at rates of 0, 60, 120, 240, and 480 pounds P_2O_5 per acre when alfalfa was planted in 1951. Three cuttings of alfalfa hay were harvested in 1951 and five in each of the years 1952, 1953, and 1954. The alfalfa was plowed down in 1955 and the area planted to sorghum in 1955 and 1956. No fertilizer was applied to the alfalfa after 1951. The main plots were divided into four subplots in 1956. Nitrogen and phosphorus were applied to these subplots at the following N - P_2O_5 rates: (1) 0 - 0; (2) 80 - 0; (3) 0 - 240; (4) 80 - 240.

The soil on which these plots are located is tentatively classified as Springer fine sandy loam. It is a well-drained Reddish Brown soil of the southern Great Plains developed from calcareous aeolean and/or alluvial material of the Pleistocene and Pliocene ages in erosional valleys to the west of the High Plains. In the Tucumcari area this soil is extremely phosphorus deficient.

The phosphorus applied in 1951 caused a difference in alfalfa yield in every cutting except the first two in 1951. Sorghum grown in 1955 responded to the 1951 treatments. The yield, nitrogen content, and phosphorus content of the grain sorghum grown in 1956 are shown in the graphs. These show that all 3 were affected by the phosphorus applied in 1951. Some of the differences are greater for the treatments applied in 1956, but all show a statistically significant effect from the 1951 fertilizer.

The 1956 yield was not increased when fertilizer was added to those plots receiving 480 pounds of P_2O_5 per acre in 1951. The phosphorus applied in 1956 increased yields on all other 1951 plots. Nitrogen applied in 1956 had no significant effect on yield. This indicates that alfalfa produced enough nitrogen in 4 years to furnish all that is required by 2 years of sorghum to balance the phosphorus that is available. A heavy initial application of phosphorus is available to crops grown 6 years later. The increase in phosphorus content of the grain resulting from 1956 applications to the 1951 480-pounds-per-acre plots suggests that most of the available phosphorus may have been used by the second crop of sorghum.

The 1951 phosphorus treatments also affected the nitrogen content of 1956 grain. This is the only factor measured that was affected significantly by the nitrogen fertilizer applied in 1956.



Yield, nitrogen content, and phosphorus content of 1956 grain sorghum as affected by P_2O_5 treatments applied to alfalfa in 1951 (shown under each set of 4 bars) and nitrogen and P_2O_5 treatments applied to sorghum in 1956 (shown within each bar), Springer fine sandy loam, Tucumcari, N. Mex.

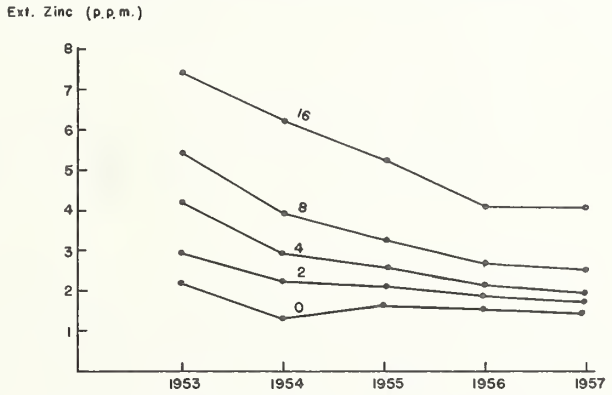
Washington

ZINC APPLICATIONS EFFECTIVE 5 YEARS LATER

Louis C. Boawn, Prosser. --Soil applications of fertilizer zinc have remained available over a 5-year period on a Columbia Basin soil. This information is the result of a field experiment started at Prosser, Washington, in 1953, which contained treatments of zinc fertilizer at rates of 0, 2, 4, 8, and 16 pounds zinc per acre. The carrier was $ZnSO_4$ and was incorporated into the 0-8 inch layer of Ritzville fine sandy loam by rototilling.

Each year, including 1953, at about July 15, 0-8 inch soil samples have been taken from the plots and a determination made to measure the amount of this fertilizer zinc which is still in available form. Also, for the years 1953 through 1956, plants growing on these plots have been analyzed to observe the effect of the different fertilizer rates on zinc content.

The curves in the accompanying figure show the amount of fertilizer zinc which has not been fixed by the soil during this 5-year period, as measured by extraction with 0.1 N HCl. Both the rate and amount of fixation is lower than might be expected when this element is applied to a neutral soil. It is evident that a zinc fertilizer application of as little as 4 pounds zinc per acre will be effective for at least 4 years. Higher rates can be expected to provide adequate zinc to plants for even a longer period of time. Where 8 and 16 pounds of zinc were applied, there appears to have been very little fixation during the fourth year, which indicates that the fixing mechanism of this soil may be satisfied by approximately 3 p. p. m. zinc. Thus, there is the possibility that fertilizer zinc in excess of 3 p. p. m. will remain available until removed by cropping.



Effect of time on the amount of zinc extractable with 0.1 Normal HCl for 5 rates of zinc fertilizer application, Prosser, Wash.

Nebraska

ZINC FERTILIZER HASTENS MATURITY OF FIELD BEANS

Fred E. Koehler, Mitchell, Nebraska. --The use of zinc fertilizer greatly hastened the maturity of field beans at three experimental sites in the North Platte Valley and on several farmers' fields in the region. Visible zinc deficiency symptoms were observed during the growing season at each site.

In one experiment zinc sulfate was broadcast prior to plowing at rates of 5, 10, and 20 pounds of zinc per acre. The beans were pulled September 11 and allowed to dry in the field for 5 days. They were then placed in burlap bags and hung in an open shed for 5 days before threshing. The moisture loss upon air drying the threshed beans used here as an index of maturity was 7.6 percent for those from the untreated plots and 4.9 percent for

the fertilized beans. All 3 rates of fertilizer applications resulted in approximately the same percentage moisture loss.

In another similar experiment the differences in maturity appeared to be even greater. However, moisture losses could not be measured because forced-air drying had to be used to prevent the beans from molding.

Zinc sulfate applied as a spray in early July also hastened maturity. The beans were harvested and immediately threshed in order to determine moisture loss. The beans which were not sprayed had a weight loss of 30 percent upon air drying, whereas the sprayed beans lost only 19 percent.

Early maturity is of practical importance to producers of field beans in western Nebraska. Many times yields are reduced by the occurrence of blight, rust, or an early frost just prior to maturity. This is especially true in years when beans are planted after another crop has been destroyed by hail or other adverse weather conditions.

Montana

NITROGEN FERTILIZER AFFECTS GRAZING DISTRIBUTION

Truman W. Massee, Havre. --Livestock grazed an area more heavily where nitrogen fertilizer was applied, even though the fertilized strip was some distance away from the watering places and normal grazing areas, A strip of rangeland on the North Montana Branch Station lease in the Bear Paw Mountains was fertilized in a 1-year preliminary test conducted from the fall of 1955 through the growing season of 1956. The objective was to note if cattle were attracted to an area which was fertilized and which was not normally grazed because of distance from water holes. It was thought that if livestock were attracted to the fertilized area, which was on a high ridge, it would reflect in a better grazing pattern of the total area.

On September 11, 1955, a narrow strip of 1.72 acres of rangeland on a high slope was fertilized with nitrogen at a rate of approximately 155 pounds N per acre.

Prior to the release of livestock in this area, paired cages were placed along the edge of the fertilized strip, one in the fertilized area and the other in the unfertilized or check area.

Beef cattle were allowed to graze the area in the spring, and the herdsman made observations on the grazing pattern. During June and July the cattle remained in the lower meadows. In August, they grazed the fertilized area heavily, removing the grass to an extent that the ground appeared bare. The fact that they grazed the area between the water holes and the fertilized area was noted both in observing the amount of grass that was eaten there and by observing the grazing pattern.

At early bloom stage, on July 20, the forage within 5 pairs of cages was harvested for yield and protein content. The forage in the remaining four pairs of cages was harvested following the first freeze in the fall.

The yield data given in Table 1 show an average increase of approximately 50 percent due to fertilizer when the forage was harvested at the early bloom stage. The high yields realized from both check and fertilized cages at site 4 reflect the better moisture relations existing in the slight depressional area along the strip where the cages were placed. Nitrogen fertilizer considerably increased the protein percentage in both the early and mature forage. These data are summarized in Table 2. It is recognized that cost data in relation to benefits are important, but in this preliminary report, these factors were not evaluated.

TABLE 1.--Forage yield as affected by nitrogen fertilizer, Havre, Mont., 1956

Site	Time of clipping	Forage yield per acre	
		Unfertilized	Fertilized
		Pounds	*Pounds*
1.....	Early bloom	2,070	1,998
2.....	"	1,770	2,202
3.....	"	1,752	2,076
4.....	"	3,096	6,558
5.....	"	2,184	2,910
Average.....	"	2,174	3,149
6.....	Maturity	1,848	1,554
7.....	"	1,476	2,280
8.....	"	1,230	1,980
9.....	"	918	1,044
Average.....	"	1,368	1,714

TABLE 2.--Effect of nitrogen fertilizer and time of harvest on protein content of forage, Havre, Mont., 1956

Site	Time of clipping	Protein content of forage	
		Unfertilized	Fertilized
		Percent	*Percent*
Average.....	Early bloom	9.7	13.3
Average.....	Maturity	5.5	8.2

Findings for the test were:

1. Livestock were attracted to an area, some distance away from their watering places and normal grazing areas, where nitrogen was applied at a heavy rate.

2. Protein of the forage was increased with the application of nitrogen.

3. The yield of forage was increased, especially in a draw where moisture was more abundant.

4. Nitrogen recovery on the early bloom cutting was 21.5 percent.

Washington

CROPPING AND FERTILIZATION AFFECT WHEAT PRODUCTION

Glenn M. Horner, Pullman. --The yield of wheat following sweetclover green manure was 50.5 bushels per acre in a 3-year rotation compared with 39.8 bushels in a 6-year rotation. The sweetclover had been grown only once in the 6-year rotation, while the green manure crop had been grown twice in the 3-year system. Also, the 1956 yield of sweetclover was low, in contrast with the high yield in 1953. The carry-over effect of the sweetclover increased the yield of wheat in the 3-year rotation.

Wheat grown after peas produced higher yields than wheat after wheat. Average yields were 62.4 and 56.4 bushels per acre for pea and wheat land, respectively.

Nitrogen fertilizer increased the yield of wheat grown the second and fourth years following the turning under of sweetclover green manure. Both the 50- and the 100-pound rates of nitrogen resulted in higher yields of wheat than wheat following the poor crop of sweetclover in 1956. The 100-pound rate of nitrogen gave yields of the same order of magnitude as wheat following normal crops of sweetclover. The data are summarized in the accompanying table.

Effect of cropping and fertilization on wheat, Pullman, Wash., 1957

Rotation	Crop in 1956	Green manure		Nitrogen per acre[1]	Wheat yield per acre
		Year	Yield per acre		
			Tons	*Pounds*	*Bushels*
3-year: Sw. clover-green manure-wheat	Green manure	(1953	3.9		
		(1956	0.4	0	50.5
6-year: Sw. clover-green manure-wheat-wheat-peas-wheat	Green manure	1956	0.5	0	39.8
	Peas	1953	4.0	50	55.1
		1953	3.9	100	69.6
	Wheat	1955	1.7	50	47.3
		1955	1.4	100	65.5

[1] Ammonium nitrate broadcast.

SOIL STRUCTURE

Georgia

SAWDUST INCREASES LARGE PORES AND DECREASES BULK DENSITY

A. W. Royer, Fleming.--High rates of sawdust applied to Bladen very fine sandy loam in the spring of 1954 effected changes in soil porosity and bulk density that have persisted after 3 years.

Three rates of sawdust and 3 rates of nitrogen were applied initially. Core samples taken from bedded cabbage rows in April 1955 indicate that sawdust applications markedly decreased the bulk density of the soil and increased the percentage of large pores drained under 60 c. m. of tension (See table.) The application of sawdust under these conditions reduced crusting and increased snap bean emergence.

Samples taken in October 1957 after smoothing and settling show that the effects of sawdust on bulk density persist after 3 years. Nitrogen fertilizer, either with or without the sawdust, had no effect on porosity or bulk density.

Sawdust per acre	Pores			Soil volume	Bulk density	
	Large	Small	Total		Row-1955	Settled-1957
Tons	*Percent*	*Percent*	*Percent*	*Percent*		
0.....	8.1	34.1	42.2	57.8	1.28	1.42
30.....	15.3	35.7	51.0	49.0	1.05	1.33
60.....	19.0	36.7	55.7	44.1	0.86	1.29

CROPPING SYSTEMS

Puerto Rico

CUTTING FREQUENCY AFFECTS YIELD, PROTEIN OF TROPICAL GRASS

Jose Vicente-Chandler, Rio Piedras. --The amount of protein in heavily fertilized merker-, guinea-, and paragrass varied greatly with length of harvest interval in an experiment conducted at Rio Piedras. All the grasses received 800 pounds N, 400 pounds P_2O_5, 600 pounds K_2O per acre annually. Total annual rainfall was about 85 inches.

The effect of cutting the grasses at 40-, 60-, and 90-day intervals on the yield and protein content of the forage produced during the first year of experimentation is shown in the accompanying table.

Species	Grass cut every 40 days		Grass cut every 60 days		Grass cut every 90 days	
	Yield of dry matter per acre	Protein content	Yield of dry matter per acre	Protein content	Yield of dry matter per acre	Protein content
	Pounds	*Percent*	*Pounds*	*Percent*	*Pounds*	*Percent*
Merker.....	24,520	12.9	44,561	9.7	75,606	6.9
Guinea.....	27,475	10.3	35,258	8.9	44,046	6.7
Para.....	23,607	11.7	30,841	9.5	36,294	7.2

These data show that yields of dry matter increased greatly with each increase in harvest interval. However, the protein content of the forage decreased rapidly with length of harvest interval. The 60-day harvest interval probably represents a good compromise between high yields and low quality on one hand and low yields and good quality on the other.

RESIDUE MANAGEMENT

Nebraska

DECAY SLOWED, OM INCREASED BY STUBBLE-MULCHING

T. M. McCalla, Lincoln. --Organic matter is higher in the surface inch of soil on stubble-mulched plots than on plowed plots after an 18-year period at the agronomy farm, Lincoln, Nebraska. The increase has not been great, but it has been consistent in those plots tested. The data are summarized in the accompanying table.

On stubble-mulched land where the residue is left on the surface, there is a sort of delayed action. The residue does not decay as rapidly as where it is plowed under and mixed with the soil to greater depth. The differences, however, may not become greater with additional time.

Influence of stubble-mulching compared with plowing on the organic matter of the soil. Samples were taken from the 0-1 inch and 1-6 inch depths. Lincoln, Neb.

Rotation	Crop when sampled	Organic matter			
		Subtilled		Plowed	
		0-1 inch	1-6 inches	0-1 inch	1-6 inches
		Percent	*Percent*	*Percent*	*Percent*
Corn, oats, wheat.....	Corn	3.8	3.7	3.5	3.7
Corn, oats, wheat.....	Wheat	4.0	3.9	3.8	3.8
Oats + sw. clover, corn, corn(a).....	1st Corn	3.9	3.7	3.6	3.6

(a) In rotation 12 years.

MOISTURE CONSERVATION

Texas

EVAPOTRANSPIRATION LOSSES HIGH UNDER 4 METHODS OF FALLOW

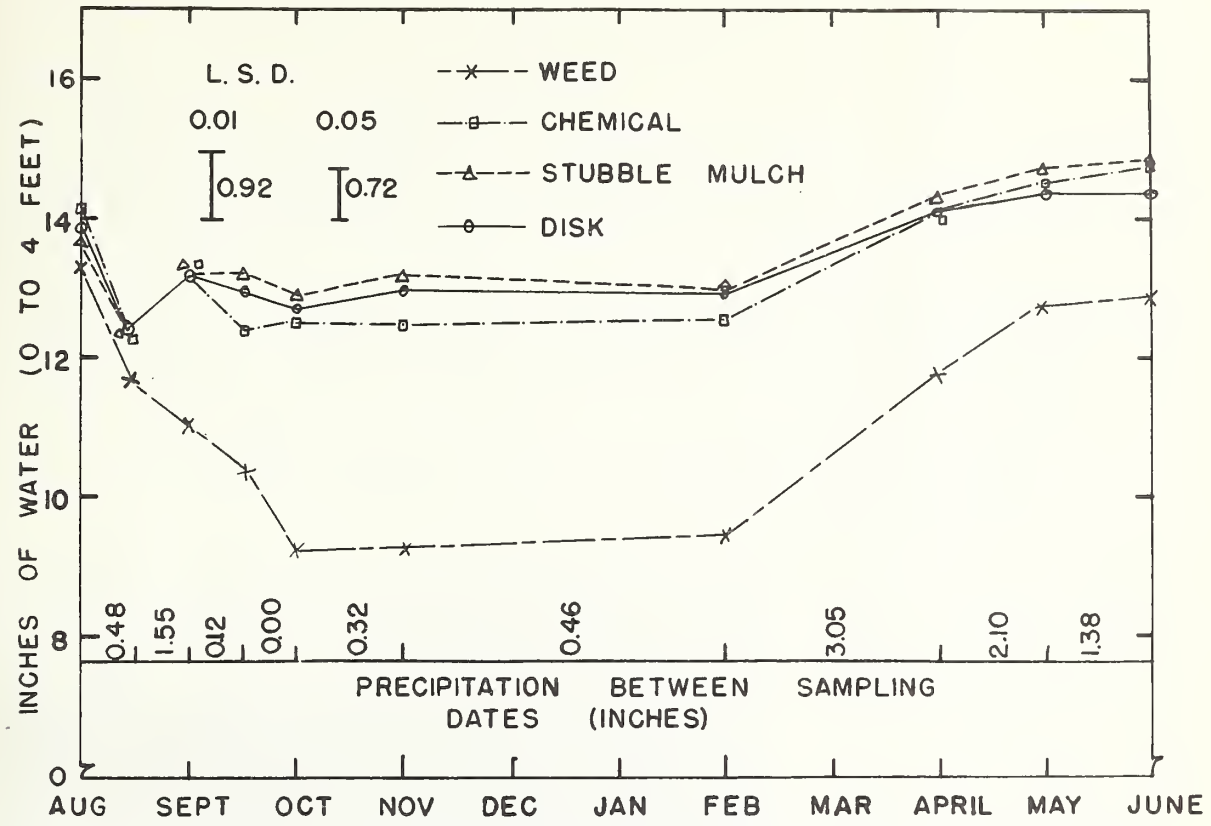
A. F. Wiese and T. J. Army, Bushland.--Total moisture and moisture distribution in the top 4 feet of the soil profile were not significantly affected by the methods of fallow tested. All methods of fallow were highly inefficient in storing precipitation.

In a study conducted on a Pullman silty clay loam, total evapotranspiration losses from the soil profile were evaluated for a 10-month period following the harvest of a winter wheat crop. Disking, subsurface tillage, chemical weed control, and untreated weedy plots were compared.

Total water in a 4-foot profile at any sampling date was not materially affected by any of the tillage treatments as seen in the accompanying figure. There were significant differences in total moisture among sampling dates. The average amount of water in the profile for all dates was 13.4, 13.6, 13.3, and 11.2 inches under disked, sweep-plowed, chemically-fallowed, and weedy plots, respectively. A significant difference ($P = 0.01$) was found only between the undisturbed weed infested plots and all others.

Fall growth of barnyard grass (Echinochloa crusgalli) on the untreated plots removed all of the available moisture in the top 4 feet of the soil by the time of the first killing frost. These plots remained dry until the onset of the heavy spring rains, after which they stored the largest amount of moisture.

During the total period of experimentation on the weedy, disked, chemically-treated, and sweep-plowed plots, respectively, 10.45, 9.56, 8.92, and 8.10 inches of moisture were lost. With 9.46 inches of precipitation during the experimental period, the inefficiency of moisture storage under the 4 types of fallow is readily apparent. Losses under fallow appear to exceed somewhat the losses obtained under stubble-mulch. However, as was previously indicated, fall weed control on the chemically treated plots was not adequate. When total moisture losses for the weedless spring period, February through June, are compared in the accompanying table, losses under chemical fallow were not statistically different from losses under stubble-mulch. It appears that where proper weed control can be obtained by the use of chemicals, evaporation losses during the fallow period are similar to what can be expected with stubble-mulching. In areas where wind erosion is a hazard, the increased amount of stubble that can be maintained on the surface when chemical fallow is employed may justify the use of chemicals as at least a partial substitute for mechanical operations.



Average inches of soil moisture in the 4-foot soil profile at the various sampling dates under different tillage methods, Bushland, Tex.

Total soil moisture loss from February through June under different weed control methods, Bushland, Tex.

Weed control method	Water lost
	Inches
Disk	5.09
Sweep	4.78
Chemical	4.34
Weedy	3.29
L.S.D. 0.05	0.99

Ohio

PLASTIC SHEET ON CORNLAND REDUCES EVAPORATION

L. L. Harrold, Coshocton, Ohio.--Preliminary analysis shows that consumptive use of water by corn, for the period of June 5 to August 31, 1957, was reduced more than 6 inches by covering the soil with plastic sheeting. The data are summarized in the accompanying table.

Evapotranspiration with and without plastic cover over surface of lysimeters, Coshocton, Ohio, 1957

Period	Evapotranspiration		Difference
	With cover[1]	Without cover[2]	
	Inches	*Inches*	*Inches*
May 1-June 4.....	3.64	----------	----------
June 5-30.....	1.81	4.35	2.54
July 1-31.....	4.14	6.67	2.53
Aug. 1-31.....	2.40	3.99	1.59
Total June 5-Aug. 31.....	8.35	15.01	6.66

[1] Covered with plastic sheet June 5.
[2] Adjusted by regression methods for differences in evapotranspiration established during calibration period.

On June 5, a weighing lysimeter, planted to corn, was covered with plastic sheeting to prevent evaporation from the soil as shown in figure 1. This also essentially stopped infiltration. For the June 5-August 31 period, stem flow infiltration and interception storage was 2.61 inches. The greater part of this is believed to have been interception storage.

The water available for producing the crop was limited to that stored in the soil on June 5 plus the 2.61 inches of stem flow infiltration and interception storage. On an uncovered lysimeter in corn the comparable value of infiltration and interception storage was 14.35 inches.

Lysimeters Y102B and Y102C covered with plastic sheet, June 5, Coshocton, O., 1957

Though the total crop yield was greater on the uncovered lysimeter--149 bushels per acre compared to 125 bushels per acre--the water use efficiency of the crop on the covered lysimeter was substantially higher. Production of corn per inch of water was 10.1 bushels per acre from the covered lysimeter compared with 6.6 bushels per acre from the uncovered lysimeter.

Maine

SOIL TEMPERATURES INFLUENCE POTATO YIELD AND QUALITY

E. Epstein and W. J. Grant, Orono.--Higher temperatures under plastic mulch increased yields of Katahdin potatoes, but quality may have been poorer, because the specific gravity was lower.

Soil temperatures at a 3-inch depth under clear and black plastic placed on the soil surface were considerably higher than under straw and in the unmulched plots (Figure 1.). These differences were more pronounced during the first 5 weeks than in the latter part of the season (Figure 2.).

Yield of potatoes increased with increased soil temperatures as shown in the accompanying table, whereas specific gravity decreased. Additional work is being done on other quality factors of potatoes.

The effect of soil temperature on yield and specific gravity of Katahdin potatoes, Orono, Maine

Mulch treatment	Yield of U. S. No. 1 per acre	Specific gravity	Average daily temperature
	Bushels		°F
Clear plastic.....	432	1.076	68.0
Black plastic.....	396	1.074	66.5
No mulch.....	328	1.080	64.5
Straw.....	320	1.082	64.0

Iowa

DEEP TILLAGE SHOWS LITTLE PROMISE IN IOWA

W. C. Burrows, W. E. Larson and W. G. Lovely, Ames.--Subsoiling and deep fertilizer placement have given no response, and in some cases, have decreased corn yields in tests conducted by the Agricultural Research Service and the Iowa Agricultural Experiment Station. Various reasons have been advanced for deep tillage, such as more rapid penetration of water and therefore more soil moisture, deeper moisture penetration into the soil with less evaporation, and even improved drainage. Deep placement of fertilizer has been said to stimulate root growth to the deeper, more moist layers of soil.

Experiments were started in 1955 at 9 locations. The treatments applied were check, subsoiling to 16 and 24 inches, and deep or surface placement of phosphorus fertilizer. Adequate nitrogen and potash were applied on the surface where needed. The soil moisture at all locations was not adequate due to an extended period of below-normal rainfall, therefore, any beneficial effects of subsoiling on soil moisture would have had a good chance of being detected. Table 1 shows the corn yields obtained at 6 of the 9 locations. The crops at the other 3 locations were lost to drought.

In no case did subsoiling produce an increase in yield. Deep-placed fertilizer was less effective than fertilizer plowed down at the Webster and Ida locations. There was no response to phosphate, either plowed down or deep, at the other locations. On the Edina soil there was a statistically significant decrease from subsoiling (19 to 1 odds). The more variable Galva location shows a yield decrease from subsoiling which is significant at odds of 8 to 1.

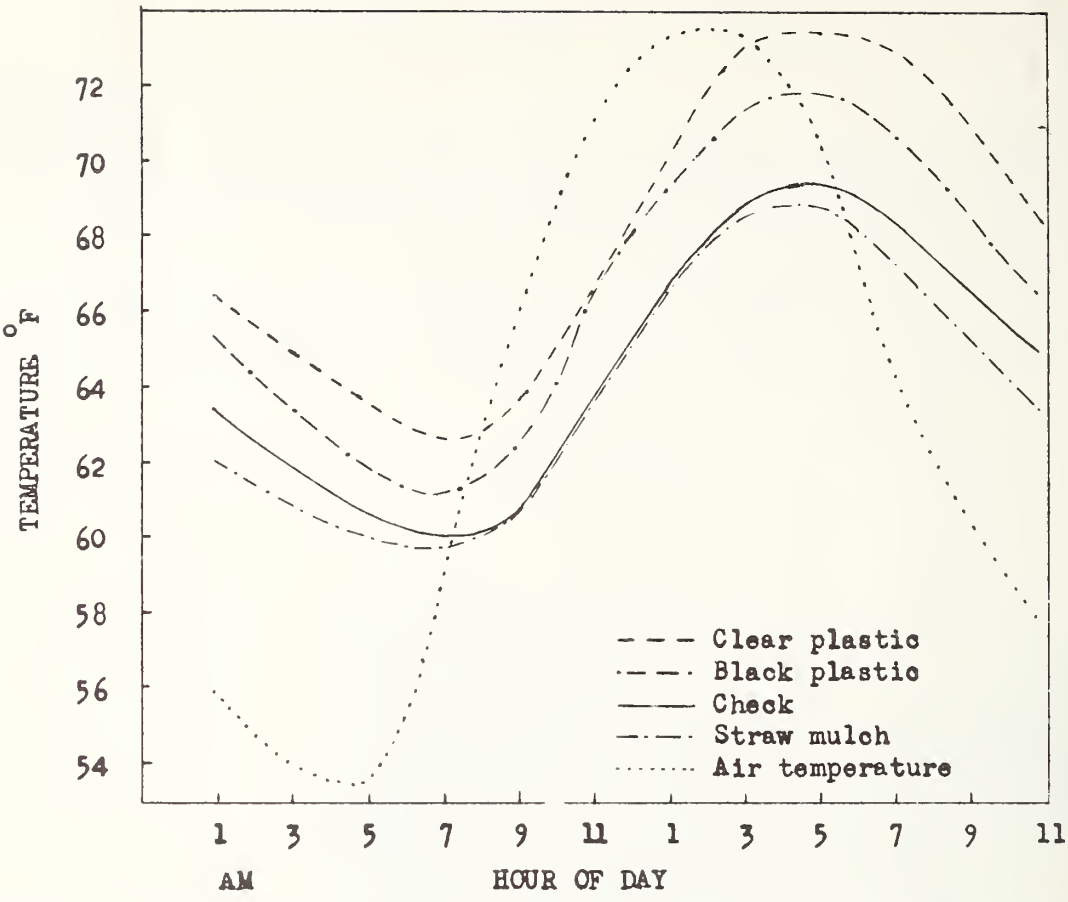


FIGURE 1.--Average hourly soil temperatures at a 3-inch depth as influenced by mulching, July 4 - September 18, 1957.

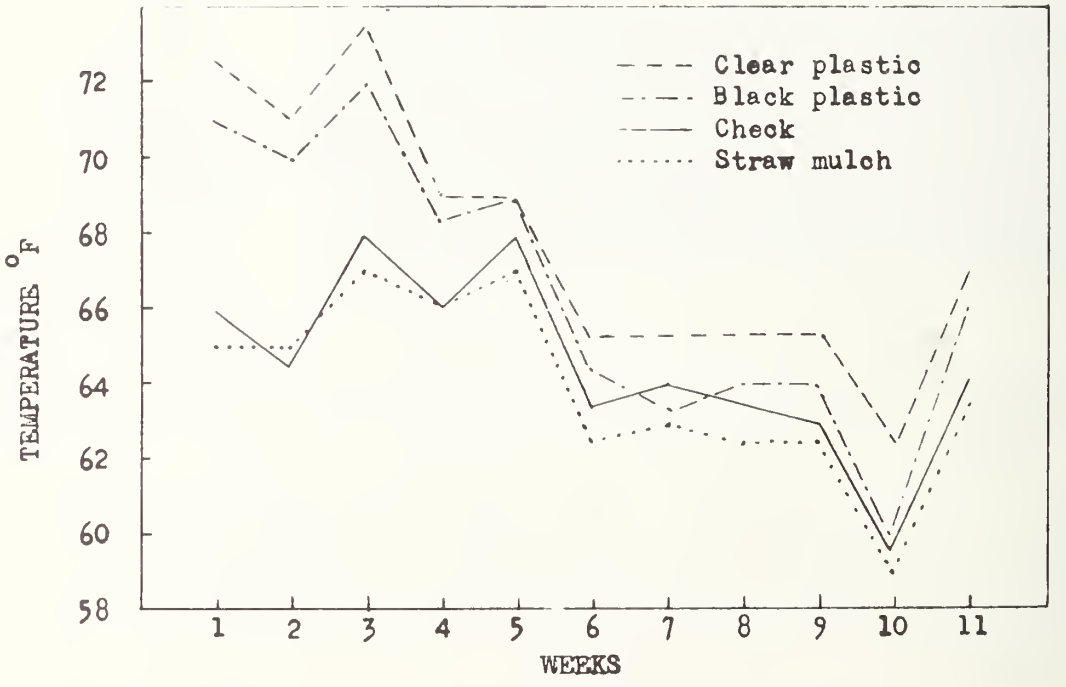


FIGURE 2.--Average daily temperatures for each weekly period from July 4 to September 18, 1957.

TABLE 1.--The yield of corn in bushels per acre as affected by subsoiling and fertilizer placement, Iowa, 1955 and 1956. (The fertilizer applied is shown in parenthesis following the soil type.)

Fertilizer placement	Corn yield per acre					
	Depth of subsoiling			Depth of subsoiling		
	None	16"	24"	None	16"	24"
	Ida silt loam (80 + 80 + 0)[a]			Galva silt loam (0 + 80 + 0)		
	Bushels		*Bushels*	*Bushels*		*Bushels*
None	19.9	----	21.0	99.9	94.2	80.7
Plowdown	41.9	----	41.0	97.5	97.7	88.3
Deep	----	----	37.4	----	78.7	87.1
	Marshall silt loam (0 + 80 + 0)			Grundy silt loam (0 + 80 + 0)		
None	52.6	48.9	47.2	77.7	77.2	76.5
Plowdown	51.9	50.4	49.3	78.3	78.8	72.8
Deep	----	47.4	52.5	----	82.2	79.8
	Edina silt loam (0 + 90 + 0)			Webster si. cl. loam (0 + 120 + 0)		
None	64.7	63.6	57.4	57.0	52.2	54.0
Plowdown	72.2	65.1	60.0	64.7	70.5	70.4
Deep	----	68.1	66.3	----	58.5	64.5

[a] This experiment was conducted in 1955 and the depth was 16 to 20 inches rather than 24 inches; the rest were conducted in 1956.

Approximately 10 months after subsoiling, undisturbed 3-inch soil cores were taken on 2 of the experiments. The samples were taken in the corn row which had been planted as nearly as possible in the slot where the subsoiler had run. The results are shown in table 2.

TABLE 2.--Effect of subsoiling in the fall on the bulk density of the soil approximately 10 months later, Ames, Ia.

Soil depth	Bulk density					
	Marshall silt loam			Webster silt loam		
	Depth of subsoiling			Depth of subsoiling		
	None	16"	24"	None	16"	24"
Inches	*gms. per cc*	*gms. per cc*	*gms. per cc*	*gms. per cc*	*gms. per cc*	*gms. per cc*
0-3	0.94	0.92	0.92	1.02	0.98	0.99
3-6	1.03	1.01	1.03	1.14	1.08	1.05
6-9	1.24	1.15	1.21	1.27	1.22	1.25
9-12	1.33	1.26	1.30	1.34	1.29	1.30
12-15	1.35	1.28	1.31	1.34	1.35	1.33

The differences between the check and 16- inch subsoiling on the Marshall silt loam in the depths from 6 to 15 inches are statistically significant. These differences, although significant, are well within the range of normal bulk density differences to be expected on the Marshall soil. The highest bulk density observed (1.35 gms/cc) is not considered high enough to adversely affect plant growth. No other difference shown in table 2 is significant. These results are to be expected, since in Iowa no impermeable layer such as a traffic pan or other layer, either induced or genetic, has been shown to exist.

The results thus far show no benefit to be derived from subsoiling or deep placement of fertilizer in Iowa, and in some cases there is the possibility of lower yields from deep tillage.

Texas

DRY SUMMER AFFECTED COTTON YIELD MORE THAN SOIL COMPACTION

R. C. Henderson and R. M. Smith, Temple.--During 3 past years, a tendency toward reduced cotton yields had been noted as a result of severe soil puddling and compaction when the land was wet. The compaction treatment consisted of running a Farmall M tractor back and forth on several dates when the soil was considered to be too wet for proper tillage.

During 1957 an additional soil compaction test was carried out on level Houston Black clay soil in continuous row cropping. However, in contrast to previous years the severe puddling or compaction treatment was carried out on only one date, March 5, 1957. On that date, a Farmall M tractor was driven back and forth twice (4 passes of the tractor) on the treated plots of 4 rows, each 40 feet long. There were 4 replicates. The soil was definitely wet. Enough loose soil was left in the beds for proper planting, but the tractor wheels were crowded as close to the beds as possible without eliminating the seedbed for planting. The cotton was planted on May 25. This is later than normal, but all planting was delayed in 1957 because of wet soil.

In addition, on March 5, a cotton bur treatment was applied in this experiment. The raw burs were added to the surface soil by hand at 3 tons per acre. Then, after the soil was dry enough for proper tillage the burs were worked into the top 3 inches of the soil by cultivation of the beds in advance of planting.

In order to check the effect of the compaction-puddling treatment, soil samples were collected on March 9 for bulk density and structural index testing by the Varsol method. The results are summarized in table 1.

The compaction-puddling influence is evident from the bulk density and the structural index values. The magnitude of the differences is similar to those reported for previous years. Also, the packed layer was denser, both moist and dry, than the normal subsurface soil below plow depth. This has been indicated earlier as typical of compaction pans in this area.

Cotton yields from the 1957 experiment are given in table 2. The averages for the 3 treatments are not significantly different. It appeared that summer drouth was the primary factor limiting the yields. Spring rainfall was above normal, but after June 5 there was practically no effective rainfall until harvest. The cotton plants were not visibly different during the course of the experiment. The results emphasize that the influence of soil physical conditions and soil amendments in this area depend upon the entire sequence of events, and especially, the climatic regimes which occur throughout the crop season, as well as such factors as the amount of moisture stored in the soil profile.

TABLE 1.--Bulk density and structural index of soil from compaction-puddling test, Temple, Tex., 1957

Treatment	Moisture content	Bulk density	Varsol structural index
	Percent	*Grams per cc*	*Drops per minute*
Loose, middles	35.1	1.13	43
	Oven dry	1.53	
Loose, rows	31.3	1.14	52
	Oven dry	1.49	
Packed, middles	28.9	1.43	8
	Oven dry	1.80	
Packed, rows	29.0	1.16	---
	Oven dry	1.48	
Subsurface, 8 to 12 inches	31.5	1.30	---
	Oven dry	1.65	

TABLE 2.--Cotton yields in the compaction-puddling and cotton bur experiment on Blackland, Temple, Tex., 1957

Treatment	Yields per acre of hand pulled bolls[1]				
	Rep. 1	Rep. 2	Rep. 3	Rep. 4	Average
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Loose soil	636	486	505	636	566
Loose soil plus 3 tons of cotton burs per acre	542	580	598	784	617
Packed and puddled soil[2]	524	580	655	598	589

[1] For conversion to pounds of lint multiply by 27 percent.
[2] Four trips with a Farmall M on wet soil on one date, March 5, 1957.

SOIL AND WATER MANAGEMENT-GENERAL

Washington

PRECAUTIONS FOR DISPOSING OF SOIL SAMPLES

J. D. Menzies, Prosser.--Anyone who has occasion to work with soil samples and to transport them from place to place should keep in mind the danger of spreading soil-borne pests. Dry soil is not sterile. It contains bacteria, fungi, nematodes, weed seeds, and even insects. Often these organisms are in dormant states and can survive in dry samples for many years.

Air-dry soil has been kept for several years to determine the survival of the verticillium wilt fungus. At the end of 4 years no decrease in the amount of this fungus was measured in the soil. Similarly, no decrease was found in the activity of the potato scab organism when kept in dry soil. In fact, it is now common practice to store cultures of soil-borne disease organisms in tubes of soil, because such cultures remain viable and unchanged for many years.

Cyst-forming nematodes and some weed seeds also persist for long periods of time in dry soil. The nematodes are particularly important, and there are several interstate quarantines designed to prevent their spread in soil adherent to plant materials.

It is therefore essential that those who use soil samples for experimental, or demonstrational purposes take particular care to avoid transporting pests. The samples should be placed in tight containers to prevent loss in transit. Surplus samples should be sterilized by heat or incinerated, or at least dumped in a non-agricultural site such as a garbage dump or pit. Above all, samples from other areas should not be added to farm land. Water samples may also contain microbial pests and should be handled with similar precautions.

The chance of introducing an important agricultural pest into a new area by soil or water samples may be very slight, but agricultural technicians cannot afford to be careless. By following careful handling procedures, the danger of contamination is reduced and the importance of soil-borne pests in agriculture is emphasized.

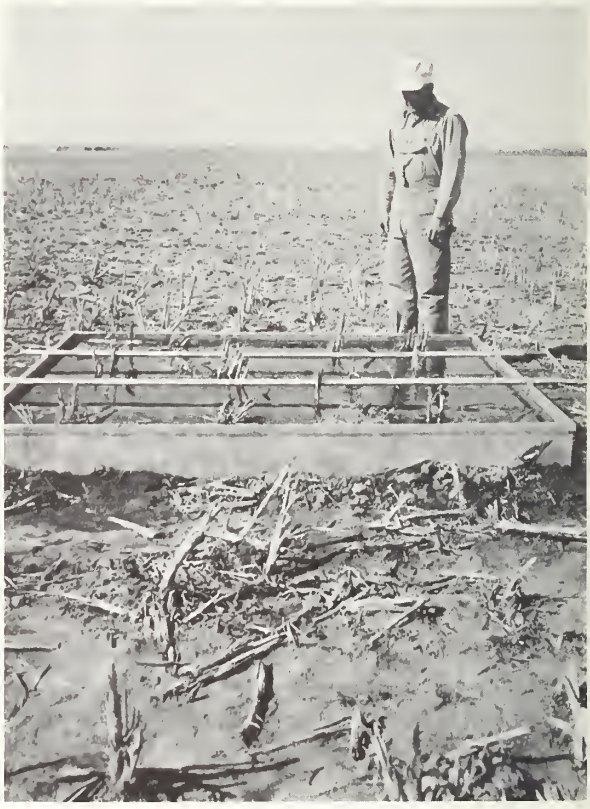
Montana

PORTABLE DIKE AIDS DRYLAND RESEARCH

Paul L. Brown, Bozeman. --Intensive studies in dryland soil and water research are often handicapped by lack of soil moisture control. In an attempt to help solve this problem, a portable metal dike for adding water to small plots was built by the Fort Hays Experiment Station, Hays, Kansas, in 1955, while the writer was located at that station.

The dike, shown in operation in the accompanying figure, is 75 by 84 by 12 inches, enclosing an area of approximately 1/1000 acre. One inch of water on this area requires slightly more than 27 gallons. This dike has been successfully used in several experiments at Hays to impose various soil moisture conditions on small plots of wheat and sorghum. (See Quarterly Reports No. 6 and No. 10)

Construction details in event others working in dry land have need for such equipment can be obtained from the writer upon request.



Portable dike used for experimental purposes in dryland research. Here the dike is filled with water. Hays, Kan., 1955

Arizona

SOIL INFLUENCES TYPE OF NATURAL VEGETATION

Joel E. Fletcher, Tucson, and James L. Gardner, State College, New Mexico. -- Soils and vegetation data from the 60-square-mile Walnut Gulch watershed near Tombstone, Arizona, showed that the present cover of vegetation is closely related to the kind of soil upon which it grows. Sampling showed that total grass cover was relatively high and shrub cover low on 4 soils derived mainly from acid igneous materials. Conversely, shrub cover was high and grass cover low on 8 soils developed on basic materials. Individual species of grasses and shrubs showed the same relationships as total cover. As would be expected from this observation, grasses, with the exception of black grama and curly mesquite, had a higher cover where the reaction of the topsoil was acid or neutral; whereas, under shrubs, the topsoil was distinctly basic, and under black grama and curly mesquite, it was slightly basic.

In spite of the generally high correlation of cover with soil series, areas that had suffered continued heavy grazing on predominantly grass-covered soils were observed to be high in brush. Conversely, conservatively used areas on soils generally brush-covered supported good grass cover and few shrubs. Although 70 percent of the entire area is now predominantly brush-covered, there is reason to believe that most of it was once grassland. Some of the older ranchers say that this is true, and John Russell Bartlett, U. S. Boundary Commissioner in 1852, described the country as grass-covered. From this and personal observations, it is believed that at least a part of the correlation of soil factors with present vegetation have resulted from grazing use and abuse of the original vegetation.

Louisiana

WATER-HOLDING CAPACITY IS A FUNCTION OF TEXTURE

Zane F. Lund, Baton Rouge. -- Textural class controls water-holding capacity in alluvial soils in Louisiana. Twenty-one profiles were sampled by textural layer in Louisiana and water retentivity evaluated. The moisture retained between 1/3 atmosphere and 15 atmospheres was used as an index of available water-holding capacity. Data characterizing the different textural layers were grouped together irrespective of series or location. The table of data shows that the moisture retained at 1/3 atmosphere tension increased as either silt or clay content increased. This would normally increase available water-holding capacity, but there was an increase in the moisture held at 15 atmospheres tension as clay content increased. This increase in amount of unavailable water cancelled the advantage of higher retention at 1/3 atmosphere. Silt particles were apparently of such size as to contribute to a large value of pores in the size range that was drained between 1/3 and 15 atmospheres tension. These data strongly suggest that available water-holding capacity is controlled by the silt fraction rather than by sand or clay.

Moisture relations for different textural classes of alluvial soils in Louisiana

Textural class	Number of samples	Particle size distribution			Moisture retained		Average available moisture
		Clay	Silt	Sand	15 Atm. tension	1/3 Atm. tension	
		Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Fine sandy loam.....	3	14.7	22.0	63.3	3.8	10.6	6.8
Loam.....	11	20.1	37.4	42.5	6.8	17.5	10.7
Silt loam.....	7	21.3	68.7	10.0	6.2	26.0	19.8
Clay loam.....	5	31.6	33.2	35.2	10.8	22.9	12.1
Silty clay loam.....	8	34.1	62.4	3.5	11.4	32.0	20.6
Silty clay....	13	44.6	47.1	8.3	16.7	33.1	16.4
Clay.....	15	63.0	30.4	6.5	25.1	42.2	17.1
Clay (Miller).	3	61.7	37.0	1.3	21.5	33.5	12.0

HYDROLOGY-GENERAL

Florida

COEFFICIENT DETERMINED FOR ESTIMATING POND EVAPORATION

John C. Stephens, and Homer A. Weaver, Fort Lauderdale.--A coefficient has been determined for relating evaporation rates from standard Class A evaporation pans to evaporation rates from lakes and ponds. Evaporation from buried steel tanks, 10.5 feet in diameter by 5.5 feet in depth, was used to represent evaporation from lakes and ponds. Other investigators have found that evaporation rates from such land tanks which are buried in the ground closely approximate rates from open bodies of water.

Tests conducted at Belle Glade, Florida, from 1953 through 1956 included measurements of losses from 1 land tank painted aluminum and another painted black to simulate ponds with sand and muck or peat bottoms, respectively. Two standard Class A pans were located on the same site. The average of the evaporation from the 2 standard pans, the annual evaporation losses from the 2 land tanks, and the ratios of the averages of the evaporation from the 2 tanks to pan evaporation are given in the accompanying table.

Annual evaporation losses from standard pans and land tanks and average tank to pan ratios, Ft. Lauderdale, Fla.

Year	Evaporation			Average ratio tank to pan
	Std. Class A pans	Land tanks		
		Aluminum	Black	
	Inches	*Inches*	*Inches*	
1953*.....	55.90	45.76	45.19	0.81
1954.....	62.81	49.46	50.58	0.80
1955.....	66.03	54.41	55.64	0.83
1956.....	69.73	60.31	61.81	0.87
			Average	0.83

*1953 data based on 10 months only.

Performance of the tanks on a monthly basis has not yet been analyzed.

The adjustment of standard pan rates through the use of coefficients as determined above should simplify the determination of pond and lake evaporation losses. In south and central Florida, evaporation from large bodies of water is an important factor in the design of drainage and flood control systems.

Virginia

NEW HYDROLOGY STUDIES

J. B. Burford, and J. H. Lillard, Blacksburg.--Ten new agricultural watersheds have been selected and are being instrumented for study. Data from these areas will be used to study the relationship of precipitation, soils, land use, topography, and other watershed characteristics to seasonal and annual water yields and peak discharges with the objective of developing procedures for predicting flows from ungaged upstream watersheds.

The new watersheds, ranging in size from 150 acres to about 3,000 acres, are located above existing structures which can be used as runoff gaging stations. The largest area is located above a concrete dam in Pulaski County; the other 9 areas are above concrete rectangular highway culverts located in Montgomery, Floyd, Halifax, Brunswick, Prince Edward, Louisa, Culpepper, and Page Counties. The watersheds were selected, with the assistance of Soil Conservation Service personnel, to represent typical soil-land use conditions from which additional hydrologic information is needed. The first 10 areas are in the Mountains, Valleys and Piedmont Regions, but it is anticipated that watersheds in the Coastal Plain will be added as the program develops.

The accompanying photographs show a typical gage well installation above a standard highway culvert (figure 1) and a conventional rainfall measuring station (figure 2).

Figure 1. --Stream gaging station for the 760 acre Crabb Creek watershed in Montgomery County, Va. The gage well and instrument shelter are located upstream and to the right of this double 6' by 6' concrete box culvert.

Figure 2. --Rain gage station R-3, located in the Thorn Creek watershed in Pulaski County, Va. The 8' by 12' enclosure contains a standard rain gage to the left of the recording rain gage.

Texas

FREQUENCY OF PEAK RUNOFF RATES AFFECTED BY RECORD LENGTH

R. W. Baird, and Walter G. Knisel, Riesel. --Continuous records of runoff from a 176-acre watershed at this Station provide an opportunity to review previous estimates of peak flow frequencies. Records are available for the 20-year period 1938-57. The watershed has had no special conservation practices at any time during the period of record.

Previously, estimates of expected peak rates of runoff for various frequencies were made for the 13-year period 1938-50. These estimates are shown in colum 2 of the accompanying table. Rainfall during this period averaged slightly more than the longtime average.

Estimate of peak flow frequencies based upon different periods of record for a 176-acre watershed at Riesel, Tex.

Return period	Previous estimate 1938-50	Subsequent estimates in relation to previous estimate		
		1938-57	1938-56	1945-57
	Ins. per hr.	*Percent*	*Percent*	*Percent*
2 years.....	1.80	86.1	80.6	69.4
5 years.....	3.05	89.2	85.2	68.2
10 years.....	3.90	89.7	87.2	67.4
25 years.....	4.93	91.3	88.2	67.1

The period 1950-56 was unusually dry, followed by a period of heavy rains in the spring of 1957.

Revisions of frequency estimates using the entire period of record are expressed in the table as percentages of the previous estimates based upon the 13-year period ending in 1950. Reductions of the previous estimate in the order of 10 percent are indicated.

If the wet year of 1957 is excluded, the previously estimated rates for different return periods are reduced in the order of 12 to 15 percent.

Had the record started in 1945, the last 13 years would have yielded estimates approximately two-thirds of the values estimated from the initial 13-year period. The period 1945-57 had an unusual number of dry years, however, and could not be considered as representative of the climate of the area.

This review points up the importance of normalcy of the period of record in frequency analyses.

HYDROLOGY-LAND USE INFLUENCES

Nebraska

PEAK RATES OF RUNOFF INFLUENCED BY CROPS AND TILLAGE

John A. Allis, Hastings, and D. L. Brakensiek, Coshocton, Ohio. --Analysis of 9 years of records from 21 small watersheds of approximately 4 acres in size shows that peak rates of runoff from agricultural areas are influenced by the crops grown and by the treatment of the watershed. Runoff from the watersheds was measured for 3 cycles of a corn, oats, wheat rotation under straight row tillage, contour tillage, and subtillage. Each year there were duplicate or triplicate watersheds in each crop under each culture.

The results are briefly summarized as follows:

1. For watersheds in each of 3 crops, the means of the annual maximum rates of runoff were:

corn	3.2 inches per hour
oats	2.8 inches per hour
wheat	2.6 inches per hour

The differences between corn and oats or wheat is significant, but the difference between oats and wheat is not.

2. For watersheds in each of 3 treatments, the means of the annual maximum rates of runoff were:

straight row	3.6 inches per hour
subtilled	2.5 inches per hour
contoured	2.4 inches per hour

The differences between straight row and subtilled or contoured is significant, but the difference between subtilled and contoured is not.

SEDIMENTATION

Nebraska

NEW SEDIMENT SAMPLERS INVESTIGATED

Herman G. Heinemann, Lincoln. --The Subcommittee on Sedimentation, Inter-Agency Committee on Water Resources at its 56-1 meeting on January 10, 1956 agreed to expand the Joint-Agency project at the St. Anthony Falls Hydraulic Laboratory. A formal Technical Advisory Committee, with membership comprised of representatives from the contributing agencies, was established to give technical guidance to the program. The primary projects that were continued or initiated are as follows:

1. Development, modification, and testing of sediment sampling equipment.

2. Procurement and calibration of sediment samplers.

3. Sediment sampling methods.

4. Laboratory analysis of sediment samples.

5. Automatic measurement of sediment in streams.

The first meeting of the Technical Advisory Committee was held at the Laboratory on July 16 and 17, 1956, and the Committee has met 3 times since. The following agencies are represented on the Technical Advisory Committee:

Agricultural Research Service	Corps of Engineers
Forest Service	U. S. Geological Survey
Soil Conservation Service	Bureau of Reclamation

Accomplishments to date include the following:

Project No. 1. A continual effort has been made to improve the existing suspended and bedload sediment samplers. When suggestions are received from the field, they are studied to determine their feasibility. Some of the ideas received from the field are being incorporated into the present samplers.

Project No. 2. The existing program of procurement and calibration of sediment samplers has continued. A stock of sediment samplers will also be retained at the laboratory for those offices that desire to rent this equipment for a short period of time.

Project No. 3. Field offices have been requested to submit suggestions concerning new techniques for operating sediment samplers and other sedimentation equipment. When new methods are approved, appropriate reports will be released to the field.

Project No. 4. Report No. 11, "The Design and Calibration of the Visual-Accumulation Tube," was completed for publication and is now in the hands of the Government Printing Office. Report No. 12, "Some Fundamentals of Particle Size Analysis," was also completed and is now ready for publication. This report may be held up for a short time because of lack of funds.

Project No. 5. After an extensive library study and consultations with many people in the field of sedimentation, it was proposed that the following 6 plans be developed for study in connection with the determination and automatic recording of the suspended sediment concentration in streams:

1. Pumping and settling of intermittent samples.

2. Continuous record of pressure difference between 2 points located 1 foot apart in a stream.

3. Nuclear radiation devices for sensing sediment concentration.

4. Acoustic devices for sensing sediment concentration.

5. Devices for measuring transmission and scattering of light using turbidity meters.

6. Electronic sensing of sediment concentration.

Pumping sampler equipment (Item No. 1) has been installed on the Loup River near St. Paul, Nebraska, and tests will be continued.

A bellows type differential pressure gage (Item No. 2) has been installed in a flume at the Laboratory and is being tested.

Preliminary tests have also been made on an acoustic device (Item No. 4) and will be continued as funds become available.

Nuclear radiation devices (Item No. 3) are also being investigated at the present time for possible further development.

Concurrent with these investigations, a study is being conducted on an automatic single-stage sampler. This is a device that has numerous milk bottles located on a rack and equipped to obtain a sample at a specific location in the stream. Considerable emphasis is being placed on this sampler at the present time, because it is the most susceptible to early development, is simple and inexpensive, and is now being used in the field where no other reasonable means of sampling are available. It was the opinion of the Committee that this method should be standardized and developed to the fullest, since it is already being used. This study is to be completed by next spring. A preliminary report on this method has been distributed.

The Technical Advisory Committee, presently under the chairmanship of the Agricultural Research Service, requests that field men of all agencies send their ideas on improvements of sediment techniques to this Committee for evaluation. These suggestions and ideas should be submitted to the Chairman. The Committee will review and evaluate all suggestions and report its findings. When worthwhile suggestions are submitted, the ideas will be distributed to all the workers in the sedimentation field through reports.

The next meeting of this Technical Advisory Committee will be held on January 9 and 10 at the St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota.

HYDRAULICS

Oklahoma

V-NOTCH WEIR ADAPTED FOR USE ON HIGHWAY CULVERTS

W. O. Ree, Stillwater.--Tests indicate that a wide crested V-Notch weir placed upstream from a highway culvert entrance provides a satisfactory runoff measuring arrangement. The V-Notch serves as a control for measuring the low flows and the culvert entrance serves for measuring the larger flows. Transition from the one control to the other is smooth and a stable rating curve results.

A wide crested V-Notch weir with 5 on 1 slopes was tested on an available culvert model in the laboratory. A range of conditions of heights of notch above the culvert floor and distances of weir from culvert entrance were tested. The effect of several combinations of these variables on the maximum capacity of the culvert was determined.

Height of weir notch above floor	Distance from culvert entrance to weir	Reduction in culvert capacity
Feet	*Feet*	*Percent*
0.25	1.50	5.11
0.25	3.00	2.07
0.25	4.00	1.52
0.50	3.00	3.07
0.50	4.00	1.26
1.00	4.00	5.55

The tests indicate that the reduction in capacity of the culverts would not in most cases be serious and that a satisfactory rating curve can be developed for the combination of controls.

LIST OF RECENTLY PUBLISHED PAPERS AND PUBLICATIONS

Some of the recently published papers and publications written solely or jointly by staff members of the Soil and Water Conservation Research Division are listed below.

Adams, J. Richard, Direct application ammonia continues rise. Agr. Ammonia News 7(5): 13, 42, 1957.

Adams, J. Richard, Trends in fertilizers. In USDA Yearbook of Agriculture 1957: Soil: 194-200 illus.

Allaway, W. H. Cropping systems and soil. In USDA Yearbook of Agriculture 1957: Soil: 386-395.

Allaway, W. H. pH, soil acidity, and plant growth. In USDA Yearbook of Agriculture 1957: Soil: 67-71 illus.

Allison, Franklin E. Nitrogen and soil fertility. In USDA Yearbook of Agriculture 1957: Soil: 85-94.

Amemiya, M., Evans, N. A., Kemper, W. D., Hastings, M. M., and Robinson C. W. Soil, water, and plant relationships under irrigation research in the Upper Colorado River Basin. Colo. Agr. Expt. Sta. Gen. Ser. Paper 669: 36 pp. illus., 1957.

Anderson, Myron S. Farm manure. In USDA Yearbook of Agriculture 1957: Soil: 229-237.

Beeson, Kenneth C. Soil management and crop quality. In USDA Yearbook of Agriculture 1957: Soil: 258-267 illus.

Bliss, Eldred S., and Muckel, Dean C. How much is enough? Calif. Vector Views 4(8): 47-52, 1957.

Bower, C. A., and Fireman, Milton, Saline and alkali soils. In USDA Yearbook of Agriculture 1957: Soil: 282-290.

Chepil, W. S. Erosion of soil by wind. In USDA Yearbook of Agriculture 1957: Soil: 308-314.

Clark, Francis E. Living organisms in the soil. In USDA Yearbook of Agriculture 1957: Soil: 157-165.

Clark, Francis E. Mid-Season leaf discoloration in soybeans. Soybean Digest 17(8): 8-9, 1957.

Clark, Francis E., Zaumeyer, William J., and Presley, John T. Soilborne plant diseases. In USDA Yearbook of Agriculture 1957: Soil: 333-339.

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